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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

August 21 - August 27, 1998

Summary 98-34

Operating Experience Weekly Summary 98-34

August 21 through August 27, 1998

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IN MEMORY OF Neil J. MacArthur

It is with deepest regret that DOE's Office of Operating Experience Analysis and Feedback (EH-33) informs you of the death of Mr. Neil MacArthur, Research Planning Inc. (RPI). Neil provided our Office with support on the Operating Experience Weekly, various Safety Notices, and DOE special reports for many years. He began work on the project as an engineer in 1992 and was made program manager in January 1996.

Neil's hands-on background in nuclear industrial operations, including participation in the U.S. Navy's nuclear propulsion program and work at commercial nuclear plants, and his commitment to high-quality work performance were invaluable to this Office. The Weekly Summary, as well as the other reports produced by RPI's Germantown staff under Neil's management, drew consistent praise for their superior quality and received special recognition from the highest levels in the Department. His contribution to our Office will be missed, as will he.

EVENTS

1. PERSONNEL CONTAMINATED DURING SEAL TUBE REPAIRS

On August 19, 1998, at the Idaho National Engineering and Environmental Laboratory Fuel Conditioning Facility, workers were performing a seal tube repair when a release of radioactive contamination to the operations corridor occurred. A health physics technician, who was monitoring the operation from outside the work area, detected the contamination when he alarmed a personnel contamination monitor. One worker in the basement was also contaminated when he walked below floor penetrations under the work area, then set off a personnel contamination monitor. Subsequent surveys of the area and personnel indicated that the highest contamination levels were at a mobile glovebox in the work area. Eleven individuals had external contamination. Of the 11, 4 received an uptake, (determined by whole body count) with the highest reading being 23 nanocuries of Cesium 137. (ORPS Report CH-AA-ANLW-FCF-1998-0005)

The work plan required workers to remove, repair, and replace a seal tube between the operations corridor and the argon cell (a hot cell with argon gas atmosphere) through a 5-foot-thick shield wall. In-cell confinement is established by placing a can over the seal tube in the argon cell, then raising cell pressure to approximately –1.0 inch of water. The can is evacuated to ensure that any leakage is into the can. Leakage is then exhausted to the air cell exhaust system (see Figure 1-1).

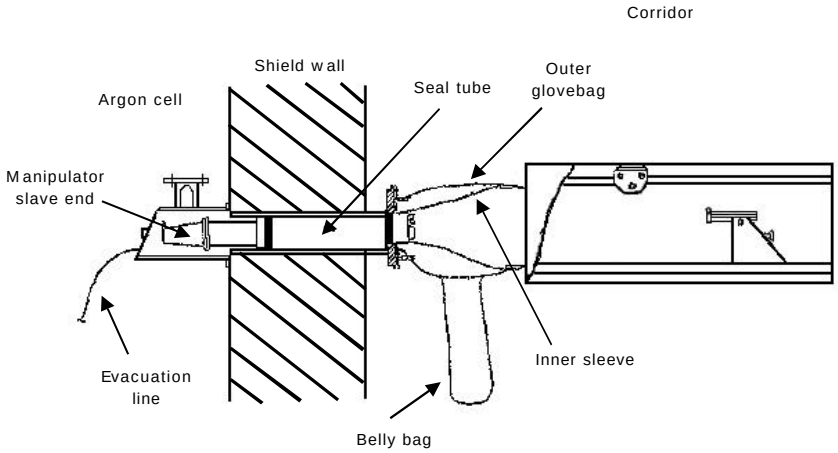

Figure 1-1. Seal Tube Set-up

Investigators suspect that contamination leakage occurred while operators were moving the seal tube into the penetration. They believe the source of the contamination was the slave end of the manipulator seal tube and that contamination escaped through the seal between a mobile glovebox and the seal tube penetration flange. The Argonne National Laboratory–West emergency action manager declared an alert. The building emergency director ordered personnel to evacuate the facility. Investigators are continuing to determine the cause of this occurrence. OEAF engineers will follow the investigation and provide information as it becomes available.

NFS reported a similar event in Weekly Summary 97-39 about an occurrence at Idaho National Engineering and Environmental Laboratory that involved the contamination of six workers and the facility while performing maintenance on a remote-handling manipulator in the Hot Cell Facility. NFS also reported in Weekly Summary 98-26 on the proposed civil penalties for deficient radiological work control processes related to that event under the Price-Anderson Amendment Act. Deficiencies identified include deficient work document preparation and review; deficient as-low-as-reasonably-achievable planning and review; failure to follow procedures, and deficiencies in radiological control training. (ORPS Report ID--LITC-TRA-1997-0021)

OEAF engineers searched the ORPS database for related events dealing with contamination spread during or following manipulator or seal tube maintenance. We found the following reports on similar events that occurred at Idaho National Engineering and Laboratory facilities.

- On March 18, 1998, a worker found contamination on his right shoe during the decontamination of a seal tube bag-out ring because of a maintenance job scope change that was not properly defined. (ORPS Report CH-AA-ANLW-FCF-1998-0002)

- On October 7, 1997, a worker's shirt was contaminated during work in the basement buffer area in the manipulator repair glove box room because of manipulator maintenance being performed in the area. (ORPS Report CH-AA-ANLW-FCF-1997-0007)

- On March 24, 1993, a health physics technician walked through the area where manipulators had recently been removed from the hot cells, then discovered contamination on her left shoe. The cause has been attributed to design of the manipulators. (ORPS Report CH-AA-ANLW-AL-1993-0005)

These events underscore the importance of control of radioactive contamination during the performance of maintenance on highly contaminated equipment. These events also underscore the importance of effective application of lessons learned. Facility managers and supervisors should review the following documents. They should ensure that radiological worker training emphasizes the need for cautious attitudes and should outline the type of mistakes that can lead to contamination events.

- DOE/EH-0256T, *Radiological Control Manual*, states: "Each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and radioactivity." The manual sets forth DOE guidance on the proper course of action in the area of radiological control. Site managers and employees should ensure they understand and can apply radiological control program requirements in the workplace to minimize radiation exposure.

- DOE-STD-7501-95, *Development of DOE Lessons Learned Programs*, discusses management responsibility for incorporating appropriate corrective actions in a timely manner.

- DOE/EH-0420, Safety Notice 94-03, "Events Involving Undetected Spread of Contamination," provides guidance, good practices, and corrective actions to

prevent the spread of contamination. This notice also contains information on common contributing causes, including (1) failure to follow applicable radiological protection procedures; (2) failure to adequately perform required surveys; (3) inadequate training for personnel involved in handling and use of radioactive material; (4) failure of radiation protection personnel to properly identify, analyze, and respond to the event; (5) failure to exercise appropriate precautions when handling radioactive material; (6) inadequate supervision or management oversight of activities involving handling and use of radioactive material; and (7) inadequate identification of existing contamination.

Under the provisions of the Price-Anderson Amendments Act, DOE can fine contractors for violations of Department rules, regulations, and compliance orders relating to nuclear safety requirements. DOE contractors who operate nuclear facilities and fail to implement corrective actions for identified deficiencies could be subjected to Price-Anderson civil penalties under the work processes and quality improvement provisions of 10 CFR 830.120, *Quality Assurance Requirements*. These actions include Notices of Violation and, where appropriate, non-reimbursable civil penalties.

The primary consideration for determining whether DOE takes enforcement action is the actual or potential safety significance of the violation, coupled with how quickly the contractor acts to identify and correct problems. The Office of Enforcement and Investigation may reduce penalties when a DOE contractor promptly identifies a violation, reports it to DOE, and undertakes timely corrective action. DOE has the discretion to decide not to issue a Notice of Violation in certain cases.

The Noncompliance Tracking System provides a means for contractors to promptly report potential Price-Anderson Amendments Act noncompliances and take advantage of provisions in the enforcement policy.

Safety Notice 94-03 can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to the U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Road, Germantown, MD 20874. Safety Notices are also available on the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: contamination, uptake, Price-Anderson Act

FUNCTIONAL AREA: Radiation Protection, Lessons Learned

2. INADVERTENT TRANSFER AT HANFORD LIQUID WASTE PROCESSING FACILITY

On August 17, 1998, at the Hanford Site Liquid Waste Processing Facility, as operators transferred process condensate from an evaporator to the Liquid Effluent Retention Facility, 5,500 gallons of process condensate were unknowingly sent to a 1-million-gallon, double-wall storage tank in the 200 East Area Tank Farm. Oncoming shift personnel noticed that a divert valve was in the divert position. Because they knew the valve should only be in divert position in

response to a signal from the leak detection system, they investigated and determined that the inadvertent transfer occurred during the previous shift. Although there were no adverse consequences from this event, inadvertent transfers of solutions can result in the mixing of incompatible chemicals or solutions, tank overflows, contamination of clean systems, and criticality safety implications. (ORPS Report RL--PHMC-200LWP-1998-0009)

Investigators determined that operators were performing cold runs of the transfer system, using raw water, when a leak detection alarm sounded. This alarm caused the transfer pump to shut down and a divert valve to reposition to the divert position. The operator believed the alarm was spurious, so he reset the alarm and restarted the pump. Investigators determined that the operator did not refer to procedures for recovering from the alarm. The procedures require repositioning the divert valve before transfers are resumed. The transfer continued for approximately 3 hours with the divert valve in the divert position, resulting in 5,500 gallons of raw water being transferred to an unintended location. Investigators also determined that a compatibility study indicates that the double-wall storage tank is the intended location for diverted transfers, that no undesirable compatibility issues resulted from the inadvertent transfer, and that procedures permitted a maximum of 150,000 gallons to be diverted. Facility managers are investigating the spurious alarms coming from the leak detection system and have suspended all transfers to the Liquid Effluent Treatment Facility pending further investigation of this occurrence.

NFS reported inadvertent solution transfer events in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-31 reported that an operator at the Savannah River Site performing a valve lineup to recirculate the contents of a tank incorrectly believed that the tank inlet valve was closed when it was actually open. This condition allowed acid to transfer to a tank that was supposed to be isolated. The operator thought the valve was closed because the valve handwheel would not turn. He also presumed the valve was closed based on the previous shift's operation of the system. (ORPS Report SR--WSRC-HCAN-1997-0031)

- Weekly Summary 96-14 reported that operators at the Savannah River Site inadvertently transferred hydrofluoric acid to a precipitator during a valve lineup because they did not follow procedure steps in the required sequence. (ORPS Report SR--WSRC-FBLINE-1996-0016)

- Weekly Summary 96-13 reported two events at the Savannah River Site, where operator inattention to detail resulted in the inadvertent transfer of nitric acid solution. Investigators determined that an operator failed to close the outlet valve of a head tank and allowed 2,200 pounds of nitric acid to transfer to a dissolver before the specific gravity of the acid was verified. In the second event, an operator opened a tank drain valve, allowing 600 pounds of nitric acid to transfer to a waste header, while performing a valve lineup for a frame waste recovery run. (ORPS Reports SR--WSRC-FCAN-1996-0005 and SR--WSRC-HCAN-1996-0009)

These events illustrate the importance of having and following procedures when transferring solutions. Inadvertent transfers create several major areas of concern. For example, solutions containing fissile materials may be subject to inadvertent criticality. Also, for many solutions, there are concerns about reactions between incompatible chemicals. These reactions may result in generating explosive, corrosive, or gas-generating mixtures. Another area of concern is the potential for off-site release of radiation or hazardous chemicals.

DOE Defense Programs Safety Information Letter, SIL 95-05, *Inadvertent Transfer of Liquid Solution,* June 1995, addresses safety problems resulting from inadvertent transfers of solutions. The SIL includes the following recommendations regarding liquid transfers.

- Use procedures—The proper use of procedures reduces the chance of unexpected results.

- Verify Lineups—Checking system alignment should guarantee the solution goes to the expected location. All lineups should be physically walked down and checked against facility documentation to identify any discrepancies.

- Hold detailed briefings—Conduct a detailed briefing with all parties involved in the event before test activities or unusual operations. Ensure each person understands what is expected and what actions to take if something unexpected happens. The briefings should identify important parameters and instrumentation to be monitored.

- Perform one task at a time—Ensure each evolution is complete and parameters are stabilized before beginning another task, if the situation allows.

- Prepare contingency plans—When preparing for any evolution think about what might go wrong and, for each instance, ensure guidance is provided to mitigate that event. Include identification of parameters and instrumentation that would indicate an unusual event is occurring.

The following references provide additional guidance related to this occurrence.

- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities,* chapter XIII, "Operations Aspects of Facility Chemistry and Unique Processes," states that operators should be knowledgeable about facility processes and safety issues that affect operation and should be able to recognize off-normal situations and take actions to correct any problems.

- DOE/EH-0502, Safety Notice 95-02, "Independent Verification and Self-Checking," describes a technique that requires workers to (1) stop before performing the task to eliminate distractions and identify the correct component; (2) think about the task, expected response, and actions required if that response does not occur; (3) act by reconfirming the correct component and performing the function; and (4) review by comparing the actual versus the expected response.

Personnel at DOE facilities can obtain a copy of SIL 95-05 by contacting Tom Rotella, Defense Programs, Office of Engineering, Operations, Security, and Transition Support, at (301) 903-2649.

Safety Notices can be obtained by contacting the ES&H Information Center, (301) 903-0449, or by writing to ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Road, Germantown, MD 20874. Safety Notices are also available on the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: operations, tank, transfer, configuration control

FUNCTIONAL AREAS: Operations, Chemistry, Configuration Control

3. GAS LINE RUPTURED DURING TRENCHING ACTIVITY

On August 7, 1998, at the Los Alamos National Laboratory, a trencher operator struck and severed a charged 1-inch natural gas pipeline. The operator immediately turned off his equipment and other equipment in the vicinity of the release. Workers evacuated the immediate area and called the support services subcontractor, who shut off the gas flow and kept personnel and equipment away until the work zone was declared safe. Although no injuries occurred and the gas did not ignite, active gas line ruptures have the potential to cause fatalities, equipment damage, or process interruptions. (ORPS Report ALO--LA-LANL-ADOADMIN-1998-0005)

Because of the depth of an excavation for a building foundation, the contractor needed to construct a ramp for equipment access. The contractor used manual digging (potholing) to locate the gas line near and parallel to the excavation boundaries. Beyond the last pothole, however, the line turned at approximately 45 degrees into the area to be excavated for the access ramp. Workers assumed the pipeline was not in the vicinity of the access ramp excavation based on what they recalled about its routing earlier in the construction project. The superintendent who laid out the limits for the excavation did not clearly mark the limits for the end of the access ramp, and the trencher operator was a few feet beyond the intended limit when the rupture occurred.

Investigators determined that the construction contractor had not conducted work in accordance with contract provisions because he did not maintain a red-line drawing at the work site for underground utilities relative to site benchmarks. They also determined that he did not direct workers to hand-excavate within 5 feet of utilities and did not consult site utility locator personnel before excavation began, as required by the activity hazard analysis.

NFS has reported on occurrences of gas line ruptures during excavations in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-44 reported that a subcontractor at the National Institute for Petroleum and Energy Research ruptured a 2.5-inch natural gas utility line while digging a trench for an electrical installation. Investigators attributed the cause to inadequate coordination and supervision of subcontractor personnel. (ORPS Report HQ--GOPE-NIPER-1997-0005)

Weekly Summary 96-04 reported three similar incidents at Sandia National Laboratories: a subcontractor using a backhoe to relocate sewer line cleanups ruptured a 3-inch polyvinyl chloride gas line; a construction contractor using a backhoe to excavate a trench ruptured a 4-inch polyvinyl chloride gas line; and a construction contractor cut into a natural gas line located approximately 20 inches below the surface. Sandia National Laboratories initiated a comprehensive investigation because of the proximity and similarity of these occurrences and implemented several improvements. These included modifying the digging permit process to more closely reflect public utility requirements and training personnel to use locating techniques and equipment similar to those used by utility personnel. (ORPS Reports ALO-KO-SNL-NMFAC-1995-0010, ALO-KO-SNL-NMFAC-1995-0007, and ALO-KO-SNL-NMFAC-1995-0003)

OEAF engineers conducted a search of the ORPS database for occurrences involving inadvertent release of natural gas or propane and identified 30 occurrences related to construction activities. A review of these occurrences shows that managers reported 53 percent as management problems and 20 percent as procedure problems. Figure 3-1 displays the distribution of root causes for these events. Further review of the management problems shows that 31 percent were reported as inadequate administrative control, and 31 percent were reported as policy not adequately defined, disseminated, or enforced.

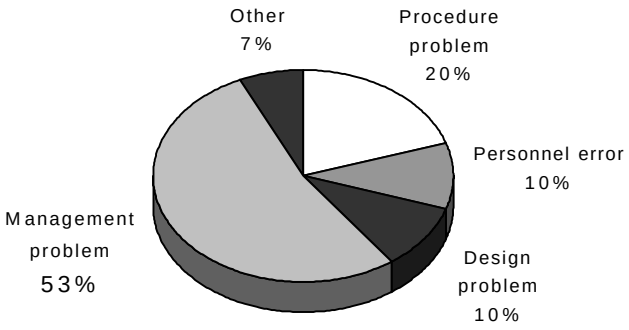

Figure 3-1. Distribution of Root Causes for Gas Line Ruptures[1]

These events underscore the importance of using effective work control practices and detailed pre-job planning. Safety and health hazard analysis must be included in the work control process to help prevent worker injury. Pre-job briefings, facility procedures, and training programs should emphasize the dangers associated with excavation activities.

DOE facility and construction managers should ensure that personnel understand the basics of work control practices, work planning, and safety and health hazard analysis. Following are some references that facility and construction managers should review to ensure they are incorporated in facility safety programs.

- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities,* states that DOE policy is to operate DOE facilities in a manner to ensure an acceptable level of safety and that procedures are in place to control conduct of operations.

- DOE O 440.1A, *Worker Protection Management for DOE Federal and Contract Employees,* contains requirements for worker safety. Part 14, "Construction Safety," of the contractor requirements document provides requirements for hazards analyses, worker hazard awareness, workplace inspections and hazard abatement, and project safety and health plans.

- OSHA 29 CFR 1926, *Safety and Health Regulations for Construction,* sub-parts .651(b) and .651(a)(3), assigns employers responsibility for identifying underground hazards near a work area. The requirements of 29 CFR 1926.965(c) state that work must be conducted in a manner to avoid damage to underground facilities. Similarly, work must be performed in a manner that provides protection to the workers.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling, and Coordination of Maintenance at DOE Facilities,* provides information on work controls and work coordination.

- DOE/EH-0541, Safety Notice 96-06, "Underground Utilities Detection and Excavation," provides descriptions of recent events, an overview of current technology for underground utility detection, specific recommendations for improving site utilities detection and excavation programs, and information on innovative practices used at DOE facilities. DOE facility representatives,

[1] OEAF engineers searched the complete ORPS database using the criteria '(natural gas OR gas line) AND (trench* OR excavate* OR dig*)' for all narrative. A 100 percent review of these events identified 30 occurrences related to construction activities.

managers, and personnel responsible for construction safety programs may want to review this document to assist in implementing effective programs.

Safety Notice 96-06 can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Road, Germantown, MD 20874. Safety Notices also are available on the OEAF Home Page at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

KEYWORDS: construction, gas line, excavation

FUNCTIONAL AREAS: Industrial Safety, Hazards Analysis, Work Planning

4. FREEZE PROTECTION REMINDER

This week OEAF engineers reviewed several freeze protection events and related documents about the potential consequences of severe cold weather on equipment, systems, and operations. With the onset of the cold weather season, personnel at DOE facilities are reminded to review their freeze protection plans and implement improvements as necessary. Facilities without such plans should begin developing them immediately. Last winter 21 freeze protection events were reported to ORPS. Severe damage can result from frozen water lines, valves frozen in position, frozen tank contents, or ice accumulation on equipment. Cold weather damage can be costly to clean up or repair and can affect facility operations. Comprehensive freeze protection programs help minimize or avoid events related to cold weather.

NFS has reported on several freeze protection events in the Weekly Summary. Following are examples of some occurrences reported during the winter of 1997/1998.

- Weekly Summary 98-02 reported that an ice plug in the cooling discharge piping of a diesel-driven standby raw water pump caused an engine to overheat, igniting the wrapping on insulation for the turbocharger and exhaust piping at the Idaho National Engineering and Environmental Laboratory. Operators, responding to complaints of low water pressure and a report of water being discharged from the pump house, went to check the diesel standby pump and found the building filled with smoke and the diesel engine making unusual noises. Investigators determined that an ice plug formed in the diesel cooling water discharge line because of a leaking regulator valve. They also found that, until 1994, the cooling water discharge line had been protected by heat tape and was checked periodically as part of the freeze protection program. However, workers removed the heat tape after an engineer erroneously determined that it was not needed. (ORPS Report ID--LITC-LANDLORD-1998-0001)

- Hanford facility managers reported to ORPS that a steam trap froze, resulting in an inoperable boiler and suspension of work in the facility because of low temperatures. (ORPS Report RL--PHMC-ANALLAB-1998-0001)

- Idaho National Engineering Laboratory facility managers reported to ORPS that an engine overheated and caused a fire because the cooling water drain was plugged with ice, which prevented circulation of cooling water through the engine coolant heat exchanger. (ORPS Report ID--LITC-LANDLORD-1998-0001)

- Rocky Flats Environmental Technology Site facility managers reported to ORPS that a fire sprinkler system froze and ruptured, spilling water into the facility. (RFO--KHLL-NONPUOPS2-1998-0002)

Burst pipes, frozen water lines, and cracked sprinkler heads in fire protection systems are frequently reported problems during cold weather. Other frequently reported problems include roofs collapsing from the weight of snow and ice, flooding when snow melts, and electrical malfunctions from water leaking into buildings. Plant status at the time of a severe weather condition should dictate actions required to place the plant in a state of readiness for seasonal facility preservation. Facility managers should consider seasonal-related problems a priority and take immediate actions to minimize damage.

Facilities managers should determine how long buildings can be without power. They should also develop specific contingency plans for connecting temporary power sources, including (1) what size generator is required; (2) where and how to connect power; (3) where to locate and ground a generator; and (4) how to introduce and route generator power cables into buildings. These contingency plans should be detailed and readily available to the personnel installing temporary power; otherwise, workers could introduce additional hazards into the work environment.

Several steps can be taken to establish freeze protection for facility systems and equipment. These steps, together with contingency plans for severe weather, should be incorporated into written procedures and periodically reviewed for adequacy. The following list identifies some typical inspections that should be performed before the cold weather season begins.

- Verify that facility cold weather checklists are available to ensure that exposed instrumentation and piping are protected from cold weather.

- Verify that facility personnel periodically calibrate and test instrumentation associated with heat tracing, space heaters, and thermostats.

- Verify that facility personnel inspect systems that have been subjected to maintenance during the past year or during the current cold weather season to determine if cold weather protective measures have been reestablished.

- Verify that facility personnel have provided adequate cold weather protection for periods of prolonged shutdowns and in areas that are not kept warm by normal operations.

- Verify that deficiencies identified during the previous cold weather season have been corrected and that modifications to correct or enhance freeze protection capabilities are appropriately prioritized and scheduled before the beginning of the cold weather season.

OEAF engineers searched the entire ORPS database and found 479 freeze protection events. Figure 4-1 shows the root causes for these events. A review of these events shows that 34 percent of these events were attributed to management problems, with an additional 24 percent attributed to design problems. Further analysis revealed that 30 percent of management problems were attributed to work organization/planning deficiencies; an additional 29 percent were attributed to inadequate administrative control. This indicates that if facility managers convey the importance of thorough freeze protection plans to employees responsible for developing them, many events could be avoided. Figure 4-2 shows the distribution by nature of occurrence for these events. A review by nature of occurrence shows that 58 percent of freeze protection events affected the facility condition. Further analysis revealed that 43 percent of events affecting facility condition were attributed to vital system/component degradation; an additional 34 percent affected operations. Site reviewers should use lessons learned from these

occurrences when conducting assessments of current freeze protection programs, equipment, and systems.

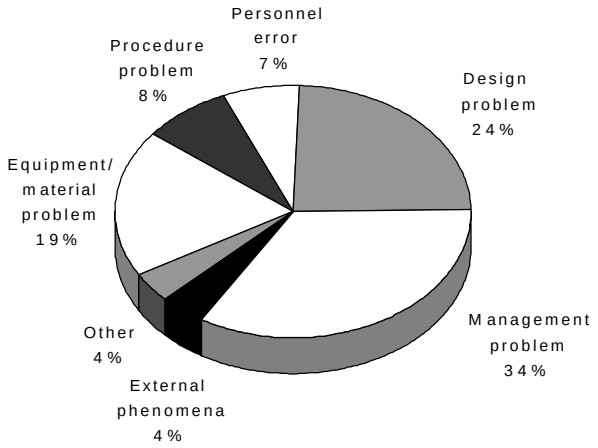

Figure 4-1. Distribution of Root Causes for Freeze Protection Events[1]

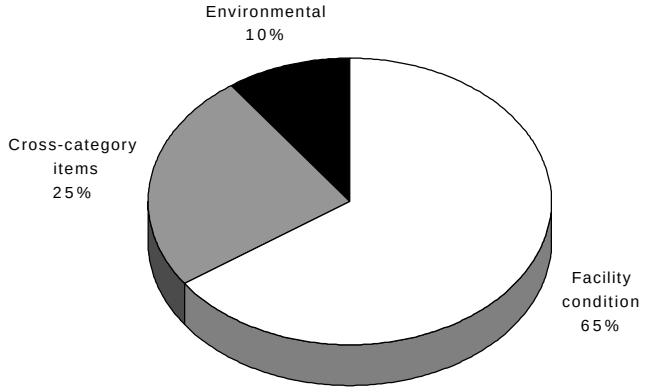

Figure 4-2. Distribution of Nature of Occurrences for Freeze Protection Events[1]

Facility managers should review their systems and equipment maintenance histories, policies, procedures, and work-planning processes and should walk-down systems to identify potential

[1] OEAF engineers searched the entire ORPS database using the graphical users interface for all narrative “freeze AND protection” and found 479 events that identified 531 nature of occurrences. Based on a random sampling of 25 events, OEAF engineers determined that each slice is accurate within ± 2 percent.

cold weather problems. Facility managers should also identify corrective actions and implement them before problems occur.

- DOE O 4330.4B, *Maintenance Management Program*, chapter II, section 19, "Seasonal Facility Preservation Requirements," requires a program to prevent equipment and building damage due to cold weather. The Order states that the program should include a freeze protection plan, including details on inspections, preventive maintenance, and corrective maintenance to ensure continued safe facility operations. Section 16, requires a maintenance history and trending program. Maintenance planners, coordinators, supervisors, and craft personnel should use maintenance history on a routine basis to identify previous maintenance work and its results.

- DOE-STD-1064-94, *Guideline to Good Practices for Seasonal Facility Preservation at DOE Nuclear Facilities*, provides guidance to assist facility maintenance organizations in the review of existing methods (and the development of new methods) for establishing a seasonal maintenance program. Section 3.4.1 of the guide includes cold weather preparation information; Appendix A provides an example of a cold weather checklist. This standard also contains guidance for hurricanes, tornadoes, cold weather, flash floods, and other natural disasters.

- DOE-STD-1021-93, *Natural Phenomena Hazards Performance Characterization Guidelines for Structures, Systems, and Components,* provides guidance on assessing system operations to identify hazards to personnel and equipment and on developing hazard prevention or mitigation measures.

- DOE-STD-1010-92, *Guide to Good Practices for Incorporating Operating Experiences*, states: "The use of experience gained should provide a positive method that a facility can use to improve their operations, making them efficient, cost-effective, and safe to the employees, the public, and the environment." Managers, supervisors, and operators should review operating experience information and implement it as the standard suggests. Lessons learned are valuable only if the information they communicate is used.

- DOE/EH-0213 "Cold Weather Protection," October 1991, Office of Environment, Safety and Health, Bulletin 91-4, provides insight, corrective actions, and recommendations applicable to sites susceptible to cold weather. This bulletin can be found at URL http://tis.eh.doe.gov:/80/docs/bull/links.html.

KEYWORDS: freeze protection, maintenance

FUNCTIONAL AREAS: Operating Experience, Lessons Learned